QUESTION 9:

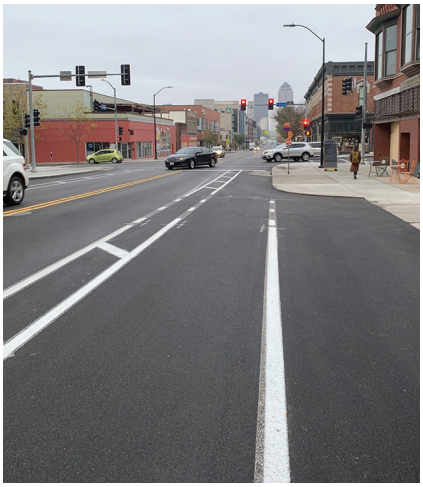
What are the potential safety impacts of bus facilities along a roadway?

A roadway cross section being considered for a four-lane undivided to three-lane (four- to three-lane) and, in some cases, other roadway cross section conversion can incorporate a number of different components. One of these components could be the addition or alteration of bus facilities. This summary provides information about the guidance on and potential safety impacts of bus facilities.

BUS FACILITIES

Two bus facilities that, in collaboration with a local transit provider, might be incorporated into a four- to three-lane or other roadway cross section conversion project are dedicated bus lanes and bus pullouts. A dedicated bus lane is a width of roadway designed and designated for bus use only, often during specific times of day. This type of facility is most common in large urban areas with significant transit service. Prospective lane conversion projects that incorporate this type of feature are typically found on roadways with frequently used transit routes.

A bus facility that might have a smaller impact and can be used along routes with less bus activity is the pullout lane, also known as a bus bay or bus turnout, at bus stops. This type of facility removes transit vehicles from the through traffic stream. The use of this type of facility by local transit providers, however, varies due to the potential operational and safety impacts on transit vehicles entering and exiting the pullout lane. As noted above, consideration of these facilities should be done in collaboration with the local transit provider.



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Bus pullout lane

Chapter 8 of the *HOV Systems Manual* (Texas Transportation Institute et al. 1998) provides an overview of the design process for high-occupancy vehicle (HOV) lanes (which include dedicated transit lanes), and Chapter 9 of the same manual contains guidance on the development of transit lanes and support facilities. The manual points out that any dedicated transit lane will include bus stops, park and ride facilities, and other support infrastructure. Generally, the manual calls for 12 foot lane widths, although narrower lanes may be used if needed. Additional guidance is provided in the American Association of State Highway and Transportation Officials (AASHTO) *Guide for Geometric Design of Transit Facilities on Highways and Streets* (AASHTO 2014a), which includes guidelines for bus facilities on streets and roadways. Finally, the design of bus stops must also comply with all applicable Americans with Disabilities Act (ADA) regulations and standards.

The AASHTO *A Policy on Geometric Design of Highway and Streets* (i.e., the Green Book) notes that while sufficient right-of-way may not always be available for bus pullouts on arterials, every opportunity should be taken to provide this feature along transit routes (AASHTO 2018). This guidance is based and focused on the movement of vehicles. The Green Book describes the features of a bus pullout as including a deceleration entry lane with a taper, a loading area, and an exit taper (AASHTO 2018). The Iowa Statewide Urban Design and Specifications (SUDAS) *Design Manual* also has various sections that include information on roadway design related to bus facilities (SUDAS 2024). Much of this information is in the Complete Streets section of the manual. For example, the Complete Streets section indicates that bus stops should be located on the far side of intersections to help reduce delays, minimize conflicts between buses and right-turning vehicles, and encourage pedestrians to cross behind the bus where they can be seen (SUDAS 2024).

The following are some of the factors to consider when bus service is present along a corridor where a roadway cross section conversion is being explored:

- The spacing and locations of bus stops and the use of pullouts may need to be re-evaluated.
- Pullouts should be selected based on the traffic volumes at bus stop locations.
- Dedicated bus lanes may improve travel times.
- Safety does not appear to be negatively impacted by the presence of bus lanes.

- Bus pullouts can decrease the severity of serious crashes but increase the number of property damage crashes, as the speeds of buses and nearby vehicles in the vicinity of the pullout are generally slower.
- Locating bus stops in proximity to intersections can have a negative impact on safety due to the increased complexity of bus and other vehicle movements. This does not negate the SUDAS guidance previously noted to locate pullouts on the far side of an intersection; rather, it suggests that the pullout itself should be set back from the intersection. In addition, as noted in the American Public Transit Association's *Design of On-Street Transit Stops and Access from Surrounding Areas*, one also does not want to locate bus stops too far from the intersection because of the impacts on jaywalking and walk transfer time (APTA 2012).

BUS FACILITY CRASH RESULTS

A limited amount of research work has focused on crashes related to bus facilities, and none of the identified studies were specifically focused on four- to three-lane conversions. The following is a summary of the more general information found about the potential safety impacts of bus facilities on roadways:

- A series of transit-related crash models were developed for arterial roadways in Toronto. These models show that higher annual average daily traffic (AADT) volumes, greater transit frequencies, longer road segments, higher percentages of near-sided stops, and the presence of on-street parking are associated with increased crashes (Cheung et al. 2008). The models do not show that bus lanes reduce crashes to a statistically significant degree.
- A simple before-and-after comparison of bus crashes along dedicated bus lanes on arterial roadways in downtown Baltimore found a 12 percent reduction in crashes following the implementation of bus lanes (Maryland Department of Transportation 2019).
- While it does not provide crash modification factors specific to bus lanes or pullouts, the AASHTO *Highway Safety Manual* (AASHTO 2014b) does provide crash modification factors for the presence of bus stops within 1,000 feet of signalized intersections. These indicate that vehicle-pedestrian crashes increase by 178 percent when one or two bus stops are nearby and increase by 315 percent when three or more stops are within 1,000 feet (Harwood et al. 2007). Note that in many areas, bus stops are typically located much closer to an intersection than 1,000 feet.
- The *Handbook of Road Safety Measures* (2nd Edition) provides the anticipated percent change in crashes resulting from the installation of bus pullouts. It notes that such facilities could reduce injury crashes (all vehicles) by 74 percent but increase property damage-only crashes (all vehicles) by 120 percent (Elvik et al. 2009).

SUMMARY

The alteration or addition of bus or transit facilities, done in collaboration with the local transit provider, is an important consideration during a roadway cross section conversation. Several factors related to these types of facilities that may be of interest are described in this summary. Some of the potential safety impacts of bus facilities along a roadway, based on the research, are also noted.

References available in: Knapp, K., and D. Veneziano. 2024. *Roadway Cross Section Reconfiguration: Responses to 14 Commonly Asked Questions.* Iowa Local Technical Assistance Program, Institute for Transportation, Ames, IA. https://intrans.iastate.edu/uploads/2024/10/roadway_cross_section_reconfiguration_w_cvr.pdf.